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Devoted to the Conversion, Transmission and Distribution of Energy

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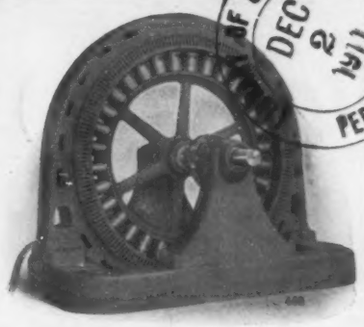

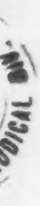

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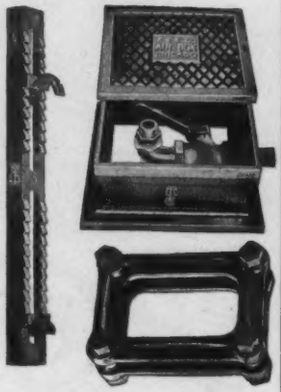

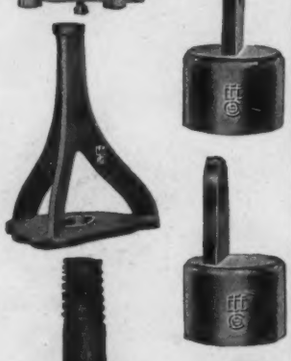

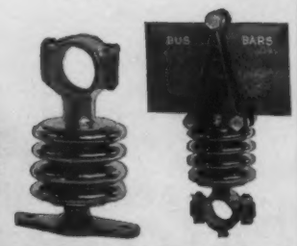

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POWER AND GAS
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A MODERN FIRE ALARM INSTALLATION

Like nearly all electrical communication systems the modern fire alarm system had its humble beginnings, has progressed through a considerable development stage, and now is coming to be regarded as a field for trained professional effort.

A Modern Fire-proof Fire-alarm Building at Oakland, California.

As in the telephone and electric light field, so the early fire alarm systems were developed by telegraphers, or those skilled in that art; but with this important difference, that while the former installations were largely in the hands of private corporations, the latter were, in general, under the control of municipalities, and became, naturally, a part of our political systems, with superintendents appointed more for their political than for their electrical skill.

Little attention was paid to the real development of the early systems, or even, in many cases, to the proper maintenance of their essential features. Boxes were allowed to become run down, and the overhead circuits were allowed to rust away until even ordinary storms were sufficient to cripple the system. The central apparatus was placed in some out-of-the-way location, usually in an engine house, with little regard for very important functions, it should be continuously ready to perform.

Oakland, California, was no exception to this

rule of progress. For many years its fire alarm system was the usual combination of obsolete devices in various stages of disrepair, amounting at times to a dangerous condition of inefficiency.

The apparatus was housed on the third floor of a brick building, surrounded by frame structures, incompatible with the nature of the system, and militating against developing efficient service.

But some eight years ago the central office was removed from its loft over an engine house and is now situated in an isolated fireproof steel and stone

Main Signal Return Room.

building of classic design, erected for this purpose in one of the city parks. The building is a single story with a deep basement. The outer walls are Utah sandstone, cream white, soft and easy to work, but of a quality that hardens on exposure. The door and window frames are metal and filled with heavy wire mesh glass. The roofs and floors are concrete, with mosaic finish on the latter, and a fireproof wainscot of beautifully veined Vermont marble.

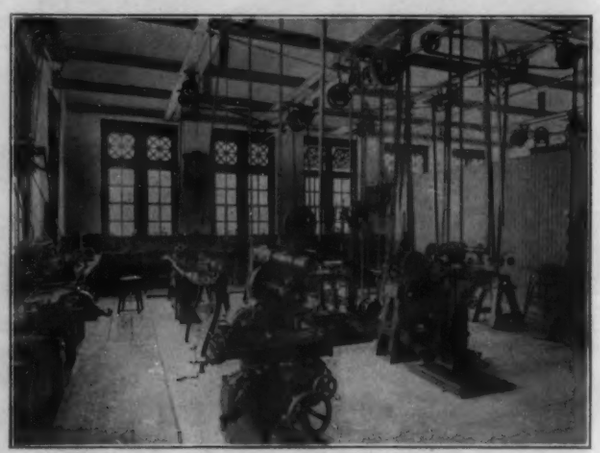
The fire alarm equipment consists of four 12 circuit, main line, storage battery, slate-base panels, mounted in steel frame and so wired that the office may be operated either manually or automatically as conditions may require. For automatic operation there are two repeaters which take up the alarm from the fire-box and transmit it through the gong lines to the engine houses. The gong lines are connected in series through each repeater, the operating table, the manual transmitter and the gong panel to the engine houses. For manual operation both the box and the gong lines are brought to the relay and tape registering table shown in the illustration. Here the box circuits are connected to the closed circuit tape machines and relays. Blinker lights are provided to flash their warning to the operator should his attention be distracted from any cause and a telegraph key permits him to signal on the box lines whenever that becomes necessary. The gong lines are also connected with keys on this table. One line passes through a master tape and time registering machine which not only punches the number of the alarm but also at the same time records the time of sending the alarm to the engine houses. When the apparatus is to be operated by hand the automatic repeaters are switched off and the gong lines are operated either through the manual transmitter, or the keys on the relay and tape register table.

In addition to the regular gong lines, high speed tapper lines are provided to be used principally for reporting engines out, or returned to service, and they are also used to signal fires. A two-dial, four-plate manual transmitter with which both gong and tapper lines are connected gives perfect control of this service. Thus the engine houses may be signaled by the repeater, by the keys on the table or by the manual transmitter.

The use of the tapper lines is further seen in the operation at the engine houses. The alarm, whether sent out automatically or manually, is there received first on the tapper line at a high rate of speed as a preliminary warning and registered on a tape and is followed closely by the alarm on the gong line given much more slowly. Companies that are not to respond to an alarm, signalled by the tapper, shut off the gong line and all the subsidiary apparatus so that the sleeping men and the horses may not be unnecessarily disturbed, but the man on watch stands ready to get a possible second or third alarm that then must sound on the gong and send the company out.

The advantage of the manual system is that the box may be run at a high speed, bringing the alarms into the central office quickly, where they are transmitted quickly to the engine houses. The lines are thereby cleared quickly for the next alarm, a feature of great importance in large cities, where at times one alarm will follow another in rapid succession.

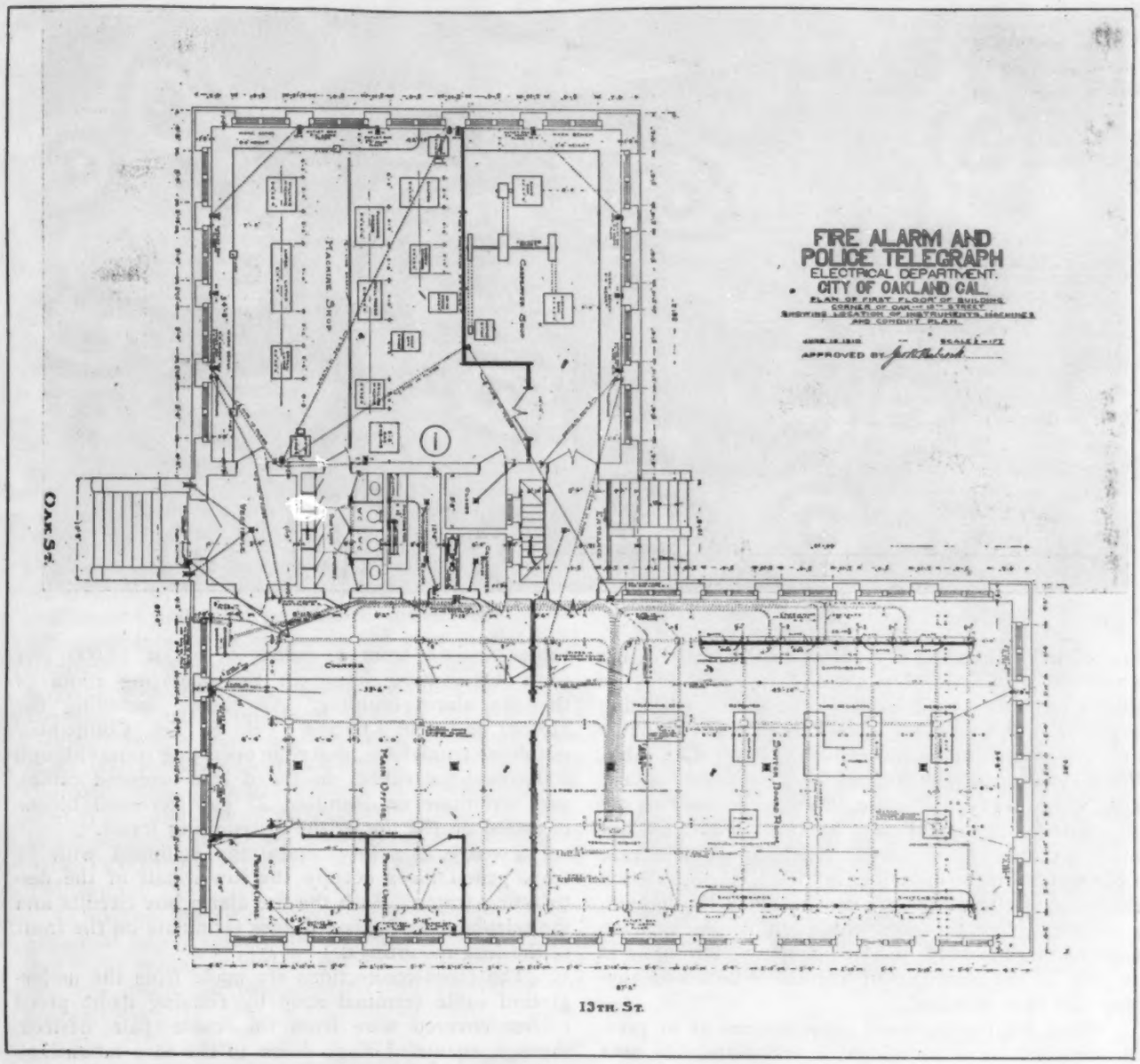
There is also a 100 local 20 trunk, private exchange telephone board (equipped at present to half its capacity) to which all the telephones of the department are connected. Trunks from both the public telephone companies are brought to this board. Through the board all the telephone business of the



Machine Room Where Fire-alarm Boxes are Manufactured.

fire department is transacted, including the reporting of fires independently of box alarms. For the latter purpose two trunk lines are used exclusively and lamps connected to them are equipped with red glass in order to attract the attention of the operator instantly.

The storage battery is situated in the basement and is mounted on metal racks and is provided with both glass and porcelain insulation. All wires from battery to board are in conduits and show only at battery terminals; in fact all wiring is in conduit, and, in the case of signal lines, in lead covered cable.



Ground Floor Plan Oakland Fire-alarm Installation.

The laying out of the building conduit system required forethought because the needs of the department for many years to come had to be anticipated. This was successfully accomplished on the checkerboard plan, with traps set in the concrete floor above the basement in such order that any part of the room may be reached from any other part without expensive cutting of floors whenever changes are necessary.

The main room is lighted at night by the indirect system. The reflections from the white walls and ceiling and from the marble wainscot and light colored stone floor gives a diffused and softened light without shadows and without glare.

A large room on the main floor, of the same width as the operating room, but extending back only half as far, is devoted to the shop of the department, equipped with modern tools of sufficient number and variety to enable a great deal of high class work to be turned out at a very considerable saving in money both on repairs and on new construction, and with an important saving in time on emergency work. Shaping machines, drill presses, lathes, emery wheels and milling machines, one of which of considerable size, furnish a wide range of capacity. Castings have to be made outside, but such things as horse releases, tape registers, gongs, fire boxes, police boxes, automomatic lighting switches and many other pieces of apparatus, with all their complex parts are made in this shop in a superior manner and with a material money saving to the city.

As with the housing of the central apparatus, so with the system of wires and cables connecting with the engine houses and other important elements of the fire department. To leave them exposed to the hazard of weather and other causes of overthrow or disruption is as poor judgment as to have no proper center of reception and distribution. As fas as practicable all such wires have been placed underground and the extensions planned will ultimately cover the entire plant. A saturated cable seems to adapt itself better to this

Storage Cells for Oakland Installation.

class of work than the dry paper, as the construction is necessarily of a mixed nature and the aerial lines are subject to contact with high voltage wires of lighting or power companies that would be very apt to puncture the insulation of the ordinary dry paper cable. The service does not demand the low electrostatic capacity of this type of cable, but does demand an uninterrupted communication at all times which the dry paper, on account of its rapid deterioration in case of puncture of the armor, does not offer. An insulation resistance of 100 megohms, if maintained throughout, is sufficient, but a higher insulation is specified because of the difficulty of holding up the terminals in the base of the pedestals of fire alarm boxes to anything like that standard.

When the underground cable system as at present provided for is completed it will consist of over 95,000 feet of lead armored, saturated core cable of from 6 to 180 conductors apiece. About one-third of these conductors are 19 gauge and are twisted in pairs to be used for telephone purpose only. The balance consists of 16 gauge straight conductors and are used for fire box and engine house circuits.

Each separate conductor is insulated with three layers of paper thoroughly saturated with a high grade compound. The insulation resistance of this style of cable varies from 300 to 600 megohms per mile. Considerable difficulty was experienced in obtaining cable of low electrostatic capacity with the saturated core feature. However, as low an average as 0.15 m.f. per mile was obtained on the last order, the first order being rejected because of a capacity of about 100 per cent above that specified.

Underground conduit space is furnished the city by the Home and the Pacific Tel. & Tel. Companies; also position for wires on their poles is furnished when desired. About one mile of underground conduit was laid in districts not covered by either of the two operating telephone companies. The main cables extend from a radius of about 15,000 feet to a distributing frame in the operating room of the fire alarm building. All cables, including the Home and the Pacific Tel. & Tel. Companies' telephone trunk lines, enter the operating room through 200 conductor rubber insulated lead armored cables, and terminate on standard 25 pair terminal blocks mounted on the top of the distributing frame.

Twenty pair fuse mountings equipped with ½ amp. pencil fuses occupy the lower half of the distributing frame. Both the fire alarm box circuits and the telephone switchboard lines terminate on the front of the fuse mountings.

The cross connections are made from the underground cable terminal strip by running flame proof rubber covered wire from the cable pair desired, through enameled rings down to the fuse mountings where connections can be made to any line on the fire alarm or telephone switchboard.

This distributing frame, (capacity 300 lines), is covered with a cabinet having glass doors on the front and back, which render the frame accessible from either side. The top of the cabinet is covered by a marble slab 4 ft. long by 3 ft. wide and has a galvonometer and bridge mounted on it, arranged for locating cable and line trouble. As the distributing frame is located on the same floor and near the fire alarm and telephone switchboard, it is easily accessible to the operator, who can make tests on lines without being called a great distance from his work.

Repeaters, operating table and manual transmitter are mounted on marble bases supported by steel frames as a further protection against fire or damage by high voltage lines.

All the contracts let were for material only. Conduit, switchboards, instruments, wiring and cable, in fact all electrical apparatus connected with the installation was installed by the electrical department of the city; thus the operating force gained a detailed

knowledge of the location and manner of installation of all the circuits. All of the work, both engineering and construction, was carried out under the personal direction of the city electrician, Mr. George R. Babcock.

Reference was made to provision for future expansion of the system. Of course it is plain that so far as laying of conduits and stringing of wires is concerned the growth of the city will offer no special difficulty, but a central station not planned on its establishment for such increase of duty would involve great expense and possible delay. In this installation the future has been considered so that expansion of capacity means but the minimum of installation of new apparatus and of expense. The present capacity is for a city of 200,000 inhabitants to which limit Oakland is fast approaching; but with the duplication of apparatus already installed and without change in the building or in any of the cable systems a capacity for a city of a million of people may easily be obtained.

The progressive spirit displayed by the people of Oakland should meet with general commendation, for it has brought about, among other great improvements, the erection of an electrical building that is one of the handsomest and most modern in the United States. Wherever interest is shown in the care of electrical equipment the electrical building of Oakland is deservedly pointed to as a pattern for this kind of construction. Further provision voted by the people of Oakland for the erection of municipal buildings gives $1,300,000 for the construction of a new city hall—the cornerstone of which has just been laid by President Taft—and allows $3,000,000 for building additional school houses, and authorizes the expenditure of $500,000 for the erection of a magnificent public auditorium.

Oakland has been exceedingly fortunate in her choice of public officials, to whose efforts during the last eight years are largely due the splendid progress she has made and the uninterrupted prosperity she has enjoyed.

SAN FRANCISCO SECTION, A. I. E. E.

The next meeting of the San Francisco Section of the American Institute of Electrical Engineers will be held at 8 p. m., Friday, December 1, at the Home Telephone Company's building. This meeting has been postponed from the regular meeting date of November 24 on account of the absence of a large number of engineers who will participate in the discussion. The paper for discussion is the "Reconstruction of a 20,000 H.P. Hydroelectric Power Plant," by Geo. J. Henry Jr. and J. H. Hansen. This paper is printed in full on this and succeeding pages in order that everyone may be prepared to discuss it intelligently. As this will be the last meeting of the present calendar year on account of the Christmas holidays and as several matters of importance are to be presented, a full attendance of all members is especially urged. These meetings are open to the public and it is hoped that the civil and mechanical engineers will lend their presence and take part in the discussion. A table d'hote dinner will be served at the Old Poodle Dog restaurant on Bush street at 6:15 p. m. before the meeting.

RECONSTRUCTION OF A 20,000 H.P. HYDRO-ELECTRIC POWER PLANT.

BY G. J. HENRY JR. and J. H. HANSEN.

The Kern River power plant of the Pacific Light & Power Company of Los Angeles has several interesting features, especially with reference to the development and installation of modern water turbines. The plant is situated on the Kern River and is also known as the Borel station of the Pacific Light & Power Company. It consists of five 2500 kw. Bullock generators, which are water wheel driven and form a part of the company's power system, furnishing Los Angeles with electricity through upwards of 150 miles of transmission line.

The water for driving the turbines is taken from the Kern River and carried through a cemented canal 12 miles long to a forebay directly above the power house. In this way a drop of 260 ft. is created and the water is taken from the forebay to the turbines through five 5 ft. diameter steel pipes each 500 ft. long. The plant is reached by an old mountain road 35 miles long, which touches an altitude of 4000 ft.

Showing Operation of Wicket Gates of Pelton-Francis Turbines.

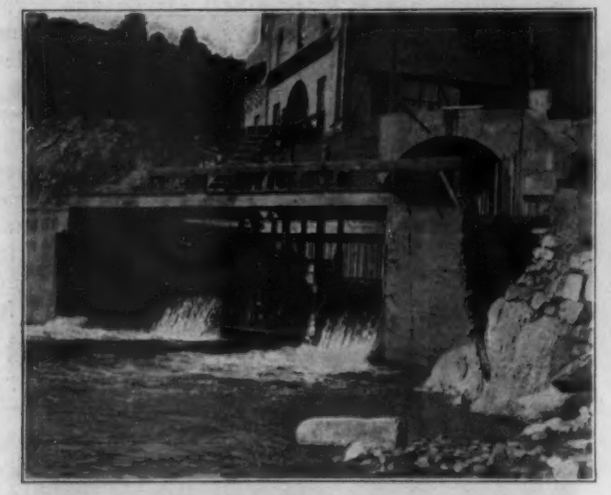
and the plant itself has an elevation of 2500 ft. above sea level.

The original installation consisted of five impulse turbines of the Girard type. The wheels were mounted overhung on the 16 in. shaft extension of the generators and the speed of the wheels was 231 r.p.m. As the power house is situated on a bank about 25 ft. above the river, the wheels were provided with draft tubes and by means of air inlet into the casing, which was regulated through a float valve in the tailrace, the water in the draft tube was to be kept a certain distance below the wheels. After about four years' operation it was decided to take out the Girard turbines, as they did not have the desired efficiency. The operation of the Girard type of wheel under these conditions proved unsatisfactory from the start and many changes were made in the structural features in an effort to better the efficiency and reliability, but without much success. The investment was extremely heavy for the power obtained, so much so as to make steam generation from oil quite attractive; and this combined with the annoyance of constant shutdowns established a strong feeling in the minds of many operators, engineers and managers of Pacific

Coast plants against turbine units in general. Turbines—in fact hydraulic power plants generally,—may be said to be like little Susie who

"When she was good, was very, very good,
And when she was bad she was horrid."

At about this time the problem was presented to the Pelton Water Wheel Company of San Francisco, who, after investigation, recommended a Pelton-Francis turbine for the conditions there involved,



Weir.

although the generator speed of 231 was quite low for this type of wheel. The use of a tangential type of wheel was opposed as entirely unsuited to the conditions. However, the Pacific Light & Power Company placed a contract with another builder for a tangential type of unit, based on guarantees of performance, which in the writer's opinion could never be met by this type of unit. As built and tested, this consisted of two wheels, each supplied with two needle nozzles set in a pit some 9 ft. below the floor line, in order to reduce the draft head to a minimum and increase the pressure head. It is our belief that nothing but disastrous results have so far been obtained, in spite of several changes in the unit, including an abandonment of the use of draft.

The Pelton company was awarded the contract for the four other units, the purchaser taking the precaution to have the first unit built, installed and thoroughly tested, in compliance with guarantees, before authorizing the manufacture of the other three units.

In the design of these Pelton-Francis turbines, with a speed constant:

$$n_1 = \frac{n}{\sqrt{H}} = 14.4$$

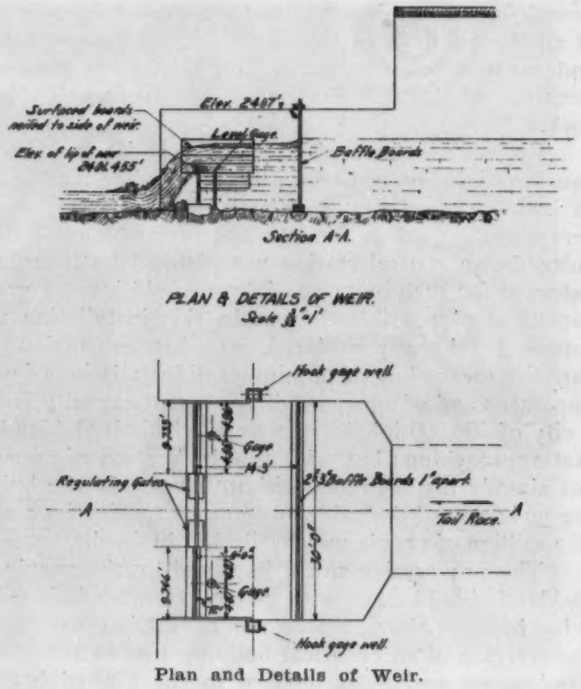
which combined with discharge constant:

$$Q_1 = \frac{Q}{\sqrt{H}} = 10.7$$

gives a specific speed:

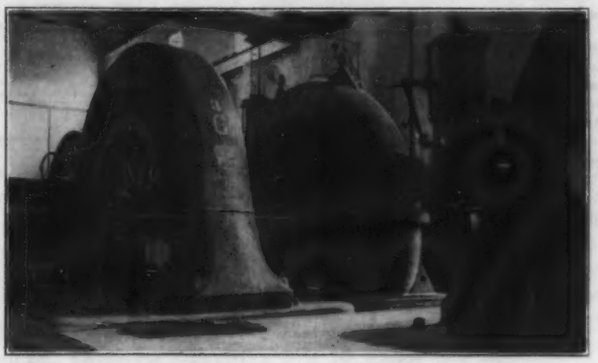
$$n_s = \frac{n\sqrt{hp.}}{H^{5/2}} = 63.5$$

in the metric system or 14.2 in English units, a runner design of rather large diameter (84 in) was necessary, thus making the surface friction and runner and casing clearances rather critical. In other words, the runner is of necessity what is known as an extremely low speed type for the attainment of best efficiencies. The large diameter of the runner of course makes necessary a large diameter of spiral casing weighing upwards of 30,000 lb. and standing 16½ ft. high. This is parted horizontally. The flow of water to the turbine may be controlled by a 42 in. hydraulically operated gate valve. The water passage to the runner is under the control of 32 cast steel wicket gates or guide vanes outside packed and of carefully plotted curvature, to insure good efficiencies at fractional loads. A cast steel gate ring actuated by the governor controls the synchronous movement of these wicket gates through suitable levers and links. The turbine runner is of manganese bronze and great care was taken in the molding to insure smooth water surfaces, being afterwards hand scraped and machined to absolute smoothness. The runner is hydraulically balanced by chambers on each side, but a double disc thrust bearing with automatic ring oiling supply is also provided. The runner discharge occurs over a fixed conical thimble surrounding and protecting the shaft and extending into the draft elbow. The reaction from the runner is thus taken up by this stationary discharge thimble, which reduces the end thrust on the bearing. The draft tube extends from the flange outlet of the draft elbow 27 ft. below the shaft center line, flaring suitably to reduce the discharge velocity to a minimum. The casing covers are made parting to facilitate access. The shaft, where it extends through the packing glands, is protected from wear by a suitable parting bronze wearing shield, which can be readily replaced. The water passage between the wicket gates and runner is protected by bronze liner plates readily replaceable in the event of wear. Aside from the adjustment provided for the wicket gates, the connecting rods between the gate ring and governor rockshaft are adjustable.



Plan and Details of Weir.

In most installations a synchronously operated relief valve is direct connected to this rockshaft to prevent water hammer in the pipe line due to the governor's action at load changes. In this particular plant, however, the governor works directly on the wicket gates, but is set to make the stroke slow enough to prevent a material pressure rise in the short pipe line.



Pelton-Francis Turbine Erected at Plant.

The first unit was completed and installed in March of this year, and on the 21st and 22d of April an elaborate test was made by James H. Wise, representing J. G. White & Company, acting hydraulic engineers for the purchaser. The efficiency was found to exceed the guarantees,—the maximum efficiency being 85.5 per cent, and the construction of the other three units was started at once.

Test.

The efficiency test is interesting, as it was made with every possible method of refinement, both on the electrical as well as the hydraulic end.

For measuring the water a permanent weir was built in the tailrace, consisting of two weirs each 9.75 ft. wide and about 10 ft. apart. Two hook gages were used and an average of six readings of each gage was taken for determining the flow of water over the weir. In calculating the water quantity, the Francis formula was used:

$$Q = 3.33\ (b - 0.1\,nH)\ [\ (H + h)^{3/2} - h^{3/2}\ ]$$

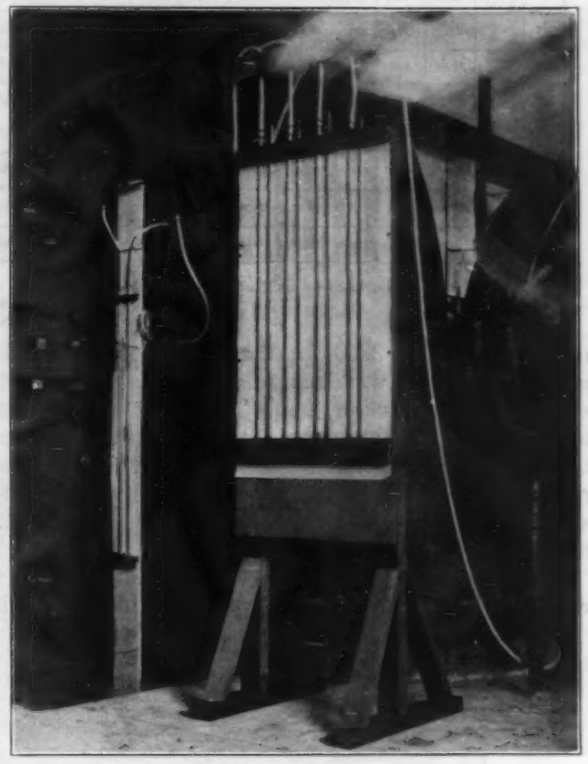
thus allowing for the end contraction and also the velocity of approach at each test.

Baffle boards evenly spaced were set 15 ft. back of the weir crest in order to get a perfectly even flow of water over the weir.

The velocity of approach did not exceed 1 ft. per second at any of the tests. For measuring the pressure head at the turbine, a Bourdon gage was connected to a prizometer ring on the inlet pipe and the average of the pressure at quarter points of the pipe was obtained. The gage was checked (in place) before and after the test with a Crosby dead weight gage tester and the necessary corrections made. The vacuum was measured by means of mercury U tubes at quarter points on the draft tube. The actual distance from center line of shaft to tailrace level was also measured for establishing the draft head which varied from 24 to 22.66 ft.

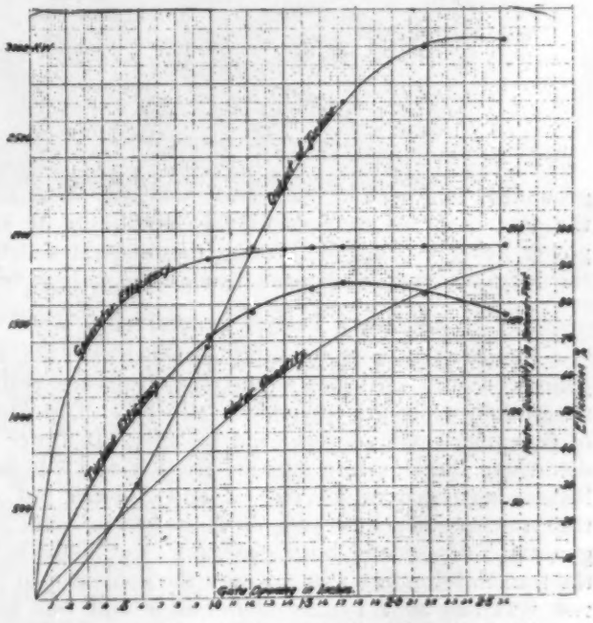
For calculating the input to the turbine, the total effective head was made up of the pressure head in the supply pipe at the turbine plus the velocity head at this point, plus draft head, all corrected to center line of shaft.

The electrical measurements for establishing the generator output and also for determining the efficiency of the generator, were made with indicating



Mercury Vacuum Gauge.

and integrating watt meters. Generator No. 3, the unit under test, was paralleled with the transmission line and partly loaded, but it was found that



Efficiency Test of 4000 H.P. Pelton-Francis Turbine.

its voltage could not be raised above 2000 volts with a unity power factor on the generator. As it was desirable to run the test with as near the normal ter-

Test No.	Time Interval	Head Measurements					Water Measurements					Input to Turbine K.W.	Generator							Output Turbine K.W.	Efficiency	Remarks
		Pressure Gage Lbs.*	Correction for Velocity Difference in Head	Effective Pressure Head Feet	Draft Head Feet.	Total Effective Head	Average of Nine Gage Readings	Discharge of Each Wheel Sec.Ft.	Correction for Velocity Difference	Total Q Sec.Ft.	Quantity used at Turbine		Speed R.P.M.	Frequency Average	Average Amperes Per Phase	Field Amperes	Terminal Voltage	Average of Nine Watt Meter Readings	Losses including Core Loss and Friction			
0							.2147	4.26	—	4.26	—	—	—	—	—	—	—	—	—	—	—	Exciter and Lighting Wheel
1	3:10 3:25	190.-	.83	278.28	24.00	262.28	.9478	61.19	.09	61.19	54.03	227.3	234	50.28	153	120	2216	515.8	101.8	617.6	80.9	
2	3:40 4:15	188.-	3.38	237.21	23.72	261.93	1.2188	92.80	.27	92.43	85.47	194.9	238.5	84.33	328	120	2210	1267.8	104.8	1372.8	71.7	
3	4:20 4:55	188.87	3.21	237.16	23.60	260.76	1.4914	114.22	.52	116.74	108.40	244.0	234	84.4	463	127.0	2224	1731.0	112.4	1428.8	78.4	
4	5:10 5:40	191.87	4.00	237.96	23.80	261.76	1.2806	128.46	.64	128.46	112.40	274.0	234	82.8	587	125	2186	2113.8	114.4	2228.2	82.3	First unit but three burned Placed in position following Grand Island unit
5	5:55 6:30	192.40	3.99	238.68	23.86	262.57	1.0747	118.38	.60	118.98	132.87	282.6	238	84.37	609	130	2192	2361.6	119.6	2481.2	82.9	
6	6:25 6:40	190.38	4.31	237.97	22.98	260.95	1.2600	140.71	.58	140.66	143.60	342.4	238	84.28	607	126	2222	2578.1	120.	2698.1	85.8	Second unit but three burned Placed in position following Grand Island unit
7	6:55 7:00	189.00	3.98	236.77	23.76	260.53	1.2548	171.0	1.18	172.18	166.00	396.2	234	84.18	741	136	2214	2862.4	124.1	2986.5	82.1	
8	7:30 7:50	188.-	10.49	238.84	22.00	260.84	2.1899	196.12	1.20	196.32	180.04	398.6	232	84.5	742	130	2166	2980.8	124.1	3104.1	78.4	

* Pressure Gage located .33 ft. below center line of Draft.

Test Results.

minal voltage of 2200 for the generator as possible, generator No. 2 was started up and also paralleled with the transmission line. Then the water of this unit was shut off, allowing it to float on the line; and by over-exciting its field, the transmission voltage was raised, so that the generator under test could be run at practically nominal voltage. All the other generators were shut down during the entire test.

As all the generators of this power station operate with the neutral point of the armature winding

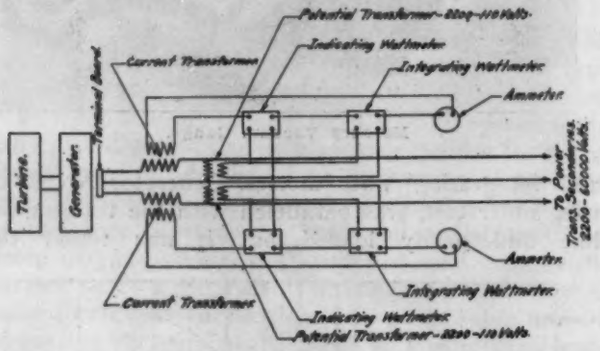


Diagram of Connections for Test on Generator #3

grounded, this ground connection was cut off during the test in order to prevent the possibility of any power being exchanged through this neutral and the third leg, which does not pass through the watt meters.

Efficiency Test of Generator.

Immediately after the full load test was made, the generator was shut down and the armature resistance taken while the copper was still hot. The "drop of potential" method was used for this. In order to determine the iron loss and the friction and windage losses, both generators Nos. 2 and 3 were put on the transmission line and then the water shut off generator No. 3 and both generators cut loose from the transmission line. In this way the generator under test was run as a synchronous motor and was now given an increased field excitation for each point of the test. The voltage of the driving generator was varied so as to give a unity power factor input to the synchronous motor. Generator No. 2, the driving machine, was held at 50 cycles by the man operating the turbine gates, he having a frequency meter at his post. From the test curve it will be seen that the maximum efficiency of the generators ran as high as 95.7 per cent for full overload and 92 per cent at half load.

The accompanying test results are self-explanatory and interesting, as they prove that a reaction turbine can give excellent results and high efficiencies under extremely unfavorable conditions, where even impulse wheels have been considered.

The hydraulic end of the test was handled by James Wise, now assistant general manager of the Pacific Gas & Electric Company, and Mr. Jos. Mini, Jr., had charge of the electrical end. Present also during the test was Mr. Woodbury from the Pacific Light & Power Company of Los Angeles.

IDAHO CEDARMEN ADOPT STANDARD LIST OF WEIGHTS OF POLES.

The Idaho Cedarmen's Association met November 7, in Spokane, at the call of President Lindsley. Several matters of interest were taken up and considered, among them the adoption of a standard list of weights of poles. A committee on publicity was appointed by the president, consisting of J. C. Davis, of the Humbird Lumber Company; H. C. Culver, of the Sand Point Lumber & Pole Company, and R. L. Bayne, of the Lindsley Brothers Company, to look into the matter of securing a greater publicity for the merits of the western cedar poles. An early issue of the Journal of Electricity, Power & Gas will contain the results of a series of careful tests on the strength of poles recently conducted by the Pacific Telephone & Telegraph Company, which show the superiority of western over eastern cedar.

STANDARD BOILER RULES.

Standard rules for the care and construction of boilers are to be made the subject of study by a special committee appointed by the American Society of Mechanical Engineers. There is reason to believe that a set of carefully prepared specifications formulated and recommended by such a committee will be recognized as a standard by legislatures and officials, and that uniformity in legal provisions will be obtained.

BREAKING OF SNOW BLOCKADES IN NORTHWEST.

That the single-phase systems is inherently fitted for electric railways is well illustrated by some experiences that the Spokane and Inland Railroad Company, which operates a 11,000 volt, single-phase line in the State of Washington, has had during the last two years.

It has been found that during the winter when the steam trains, operating on routes paralleling that of the single-phase, are unable to get through without considerable delay, single-phase trains hold very closely to their schedules. The principal reason for this is that on a single-phase road the voltage is so high that it holds up to almost normal even when the motors on the locomotives or cars are drawing very heavy currents. Upon an ordinary 600 volt road when the cars must "buck" snow, the current consumption is so great that the line voltages usually drop to a value too low for effective operation. On a steam road the ability of a steam locomotive to haul loads is actually reduced in cold weather because of the greater losses of heat from the locomotive. The reverse is true with an electric locomotive because in cold weather the motors are maintained at a much lower temperature than in warm weather, hence their ratings are increased.

As indicated in the illustration the only plough used on the Spokane and Inland trains was one of the usual shield type mounted on the pilot. This has proven to be entirely effectual in keeping the line clear enough of snow for satisfactory single-phase operation.

The winter of 1909 and 1910 was one of the most severe ever experienced in that vicinity. The Spokane and Inland was the only local road that maintained its regular scheduled service through this trying winter. At no time during the worst storms was the Spokane and Inland trains more than 20 minutes behind its schedule. This excellent showing was maintained even when there was a foot or more of snow on the ground and six to ten feet of it in cuts. No regular snow plough is used on the Spokane and Inland lines.

The illustration shows a train just after arriving in Spokane 20 minutes late after riding through a storm that completely tied up all the steam roads in the vicinity. The Spokane and Inland motor car shown in the illustration is equipped with four No. 132 Westinghouse single-phase motors and Westinghouse HB control.

Electric Train Arriving in Spokane When All Steam Roads Were Tied Up.

BIDS FOR ELECTRIC CARS.

Bids for constructing 43 cars of the pay-as-you-enter type for the Geary-Street municipal railroad were opened Wednesday by the Board of Public Works. Separate proposals for all-steel and semi-steel cars were asked. Only one bid was received for all-steel cars. It came from the Pierson-Roeding Co., representing J. G. Brill & Co., of Philadelphia, these manufacturers offering to furnish such cars for $9600 each. Their bid for semi-steel cars was $7950 each. The other bids for semi-steel cars were: W. L. Holman & Co. of San Francisco, $7393 each; McGuire-Cummings Mfg. Co. of Chicago, $7145 each; Jewett Car Co. of Newark, O., $6554 each. The lowest bid, that of the Jewett Car Co. of Ohio, amounted to $287,222 for cars and extra trucks. That of the San Francisco car manufacturing concern, the Holman company, was $50,000 greater, aggregating $337,222. The other totals were: McGuire-Cummings Co. $312,635; Pierson-Roeding Co. $419,300 for all-steel and $348,350 for semi-steel. The award of the contract was deferred until next Wednesday.

SIMPLE LAWS OF EXPANSION.[1]

BY ROBERT SIBLEY.

We come now to a consideration of the laws of expansion of perfect gases touched upon in the fifth lecture of this series. It will be recalled we found that in a so-called perfect gas the pressure, volume, and temperature are always related, as expressed in the following equation:

$$pv = RT \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (1)$$

in which p is the pressure in lb. per sq. ft., v the volume of one lb. expressed in cubic ft., T is the absolute temperature in Fahrenheit degrees, and R is a constant for each particular gas, having a value of 53.37 for air.

Since we are now about to enter upon a discussion of methods of computing power in various steam, air, and other gas engines, it is necessary for us not only to thoroughly understand this relationship, but also some of the laws of expansion met with in engineering applications.

We have defined specific heat in previous lectures as being the quantity of heat necessary to raise one lb. of a substance one degree in temperature. In the case of gases, however, we find that in general a gas has two specific heats. The specific heat at constant volume, C_v, is the quantity of heat necessary to raise the gas one degree in temperature, the volume remaining the same. For air this quantity of heat is 0.17 B.t.u. or 132 ft. lb. The specific heat at constant pressure C_p, is the quantity of heat necessary to raise the gas one degree in temperature, the pressure remaining constant and the volume expanding to accommodate the new conditions. For air this quantity of heat is 0.239 B.t.u., or 186 ft. lb.

It is evident, then, that heat is utilized for something else than actually raising the temperature, and this something else is exactly what we desire to look into, for, as engineers, we find it has the most useful applications. As engineers we are interested in anything that can do work. We define work as a product of a force and the distance through which the force acts. Thus in a steam engine the total force in lb. acting on the piston head multiplied by the stroke in ft. gives us at once the ft. lb. of work done each stroke. If then P is the pressure in lb. per sq. in. and A is the area of the piston head in sq. in., the total force is PA lb., and if this force acts through a distance of L ft., the same being the so-called stroke of the engine, the work done is PLA ft. lb. per stroke. Again, if there are N strokes per minute the total ft. lb. of work per min. are PLAN. Now we define one horsepower as work at the rate of 33,000 ft. lb. per min. Hence the horsepower in any engine is at once

$$H.P. = \frac{PLAN}{33{,}000} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (2)$$

We are interested in computing the particular value of P to substitute in the above formula. It is evident in any given case that the pressure will be different at different parts of the stroke. Hence in the succeeding lectures we shall devote considerable attention to methods of computing an average for P, or, in other words, such a value that we can substitute directly in our formula above and accomplish exactly the same results we would otherwise accomplish by taking the instantaneous values of the pressure at different parts of the stroke.

When heat is supplied to a gas, this energy in general performs two functions. Part of the energy goes toward raising the temperature and the remainder toward performing work. Hence the thermodynamic efficiency of a heat engine is always at once computed by taking the ratio of the actual work done by the gas to the total heat energy supplied. In order to make a gas expand or compress at our pleasure, we must have means of supplying heat and drawing it off at proper intervals. A regulation of the pressure, too, must also be under our control.

Let us suppose that we have in the cylinder in Fig. 28, 10 units of air by volume and that the air is under 10 units of pressure. This, plotted to scale below, is shown at 1 in the pressure-volume diagram. Now by means of pipes a a . . . let us admit heat in sufficient quantity to cause the air to expand and at the same time raise the temperature of the air. The piston head shown at B C will be pushed forward to E F. Let us suppose that the line 1-2 correctly represents the volume and pressure at any point during this movement. At the point E F, let us now manipulate the cooling pipes bb . . . in such a manner that as the air still further expands to I J, the temperature is reduced and the pressure falls off so that the line 2-3 correctly represents the pressure and volume at any position of the piston head. On the return stroke, as the piston moves from I J to G H, the pipes a and b are manipulated so that proper quantities of heat are supplied or drawn off to make 3-4 represent the pressure and volume in a law similar to the expansion from 1 to 2 and the point 4 is at such a place that when the piston head completes its stroke from G H to B C heat is supplied, or drawn off on a similar law to that from E F to I J so that the compression curve 4-1 is similar to the curve 2-3 and exactly closes at 1. Such a series of operations is known as a cycle and depending upon the particular nature of its composing curves has very important applications in heat and gas engines of all kinds.

Now as the piston in the above figure was forced to move from B C to E F, it is evident that it was necessary to supply heat in sufficient quantity to raise the temperature of the gas from that at 1 to the temperature at 2. Since C_v heat units are necessary to raise the temperature of the gas one degree, to raise it $(T_2 - T_1)$ degrees requires $C_v (T_2 - T_1)$ B.t.u. But heat is also required to do external work in shoving the piston ahead. We have seen that work is the product of a force or pressure and the distance past through. By looking at the diagram, this pressure is evidently variable. Take a small distance u v as shown in the diagram, in fact so small that the pressure is constant over this distance, and evidently the work done is $p \times u\,v$. If now I divide the entire diagram into similar small distances and scale off the corresponding pressures, I can form a series of these products of small distances and pressures corresponding

[1] This paper comprises the Twelfth Lecture of the series appearing in these columns entitled "Primer of Applied Thermodynamics," which is a resume, devoid of higher mathematics, covering the essentials of a series of lectures now being given by the editor of this Journal before the Mechanical Engineering students at the University of California.

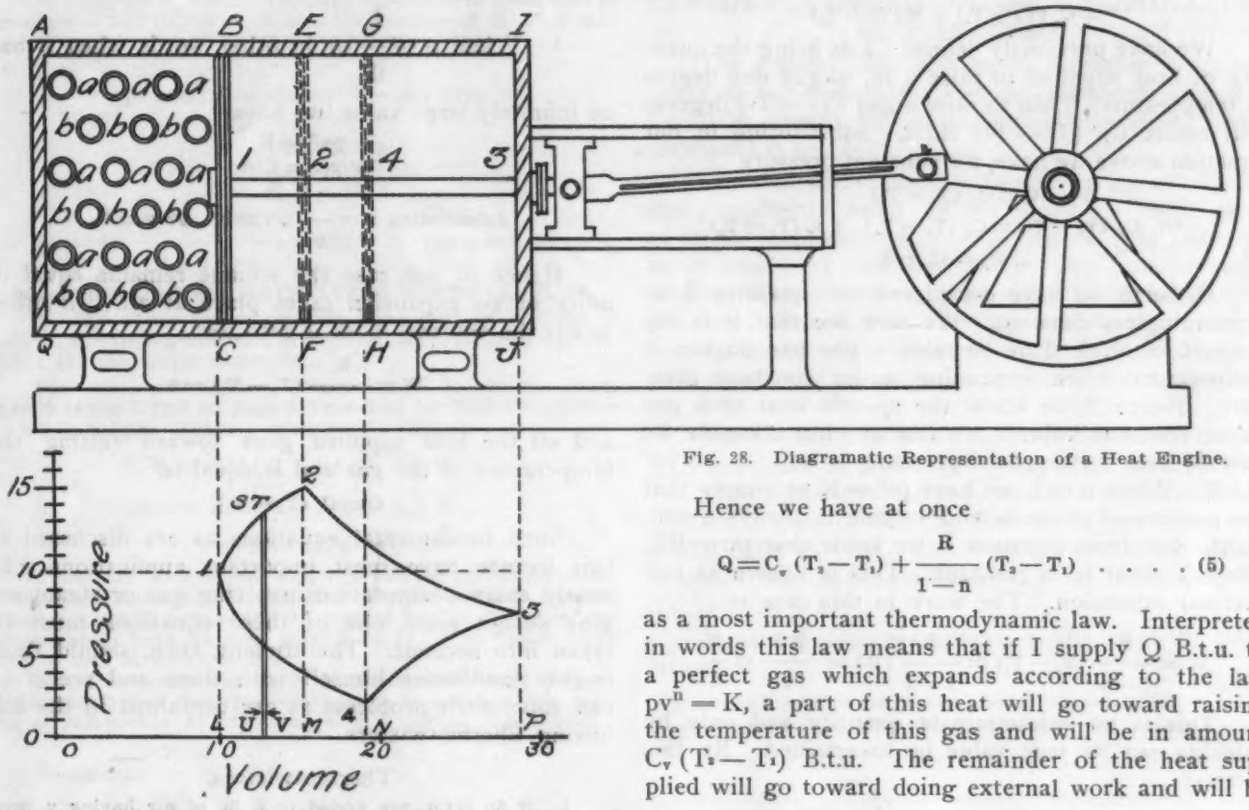


Fig. 28. Diagramatic Representation of a Heat Engine.

to each particular small distance. Since the bore of our cylinder creates a constant increase in volume as the piston head moves forward this distance is evidently proportioned to the volume and it is also evident that the work done and computed by adding the small products above referred to, is the area 1 2 M L as shown in the diagram. Hence, if I simply take a planimeter and measure this area or if I compute the area by any other method I compute at once the work done. Hence we have the important expression

$$Q = C_v (T_2 - T_1) + \text{Area } 1\,2\,M\,L \quad . \quad . \quad . \quad . \quad (3)$$

in which Q is the heat supplied and is all accounted for in the right hand side of the equation; namely, a portion used in heating the gas and the remainder in doing external work.

As hinted at previously in these lectures the expansion of gases seems to obey expoential laws. The general law of expansion is assumed to form

$$pv^n = K \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (4)$$

in which n and K are constants and can be determined when a series of values for p and v are taken by experiment in any given case.

Having now assumed that our law of expansion is of the form $pv^n = K$, we need only to compute the value of n from experimental data as illustrated in the lecture on How to Determine Empirical Formulas and we find we can at once compute the work the gas will do under given conditions and also the temperature, pressure, and volume relations. From methods of integral calculus, we can now derive a numerical value for the area 12 M L shown in equation 3, which depend solely upon this value n. We find in this higher realm of reasoning that area 1 2 M L is equal to

$$\frac{R}{1-n}(T_2 - T_1)$$

Hence we have at once

$$Q = C_v (T_2 - T_1) + \frac{R}{1-n}(T_2 - T_1) \quad . \quad . \quad . \quad . \quad (5)$$

as a most important thermodynamic law. Interpreted in words this law means that if I supply Q B.t.u. to a perfect gas which expands according to the law $pv^n = K$, a part of this heat will go toward raising the temperature of this gas and will be in amount $C_v (T_2 - T_1)$ B.t.u. The remainder of the heat supplied will go toward doing external work and will be in amount $\frac{R}{1-n}(T_2 - T_1)$ ft lb. It is important to note that the former is expressed in B.t.u. while the latter quantity in the right hand side of this equation is expressed in ft. lb. of energy.

From this one equation we can deduce important results for particular values of n. Thus, aside from the general law of expansion we often desire to study the relations between heat supplied, rise in temperature and work done when heat is supplied and the gas remains under constant pressure, constant volume, or constant temperature. Again, a most important relationship is that known as adiabatic expansion, This expansion takes place when the gas expands without heat being added or taken away, the gas simply doing external work by calling on its internal reservoir of energy by virtue of its temperature above absolute zero. Let us for a moment look into these relations:

1. When $n = 0$, we have $pv^0 = K$, or $p = K$.

This means that since the pressure is always equal to a constant the gas expands under constant pressure.

We have seen from equation 5 that the work done is expressed as follows:

$$W = \frac{R}{1-n}(T_2 - T_1)$$

Hence for constant pressure

$$W = \frac{R}{1-0}(T_2 - T_1) = R(T_2 - T_1)$$

$$\text{Also } Q = C_v (T_2 - T_1) + \frac{R}{1-n}(T_2 - T_1)$$

$$= C_v (T_2 - T_1) + R (T_2 - T_1)$$

We have previously defined C_p as being the quantity of heat supplied to raise a lb. of gas one degree in temperature. Then to raise a gas $(T_2 - T_1)$ degrees will rquire $C_p (T_2 - T_1)$ B.t.u. Substituting in our equation above we have, for constant pressure

$$Q = C_p (T_2 - T_1)$$

$$\text{Or } C_p (T_2 - T_1) = C_v (T_2 - T_1) + R (T_2 - T_1)$$

$$\therefore C_p = C_v + R$$

Hitherto we have considered this quantity R as a meaningless constant. We now see that it is the amount of work done to raise a gas one degree in temperature when expanding under constant pressure. Hence if we know the specific heat of a gas under constant volume we can at once compute its specific heat for constant pressure.

2. When $n = 1$, we have $pv^1 = K$ or simply that the product of pressure and volume is always a constant. But from equation 1, we know that $pv = RT$, hence T must be a constant. This is known as isothermal expansion. The work in this case is

$$W = \frac{R}{1-n}(T_2 - T_1) = \frac{R}{1-1}(0) = \frac{R \cdot 0}{0} = \frac{0}{0}$$

This is an indeterminate quantity and only by calculus can its true value be ascertained. By this method

$$W = p_1 v_1 \log_e \frac{v_2}{v_1}$$

Hence the special form of equation 5 for this case is

$$Q = C_v (T_2 - T_1) + \frac{R}{1-n}(T_2 - T_1)$$

$$= p_1 v_1 \log_e \frac{v_2}{v_1}$$

It is evident then that all of the heat supplied goes toward doing external work which is most important from an engineering standpoint.

3. When $n = \frac{C_p}{C_v}$ or 1.41 in case of air, we have $pv^{C_p} = K$. Substituting in equation 5 we have

$$Q = C_v (T_2 - T_1) + \frac{R}{1-n}(T_2 - T_1)$$

$$= C_v (T_2 - T_1) + \frac{R}{1 - \frac{C_p}{C_v}}(T_2 - T_1)$$

$$= C_v (T_2 - T_1) + \frac{R C_v}{C_v - C_p}(T_2 - T_1)$$

$$\text{But } C_v - C_p = -R$$

$$\therefore Q = C_v (T_2 - T_1) - C_v (T_2 - T_1) = 0$$

When $n = \frac{C_p}{C_v}$, we see then, that the gas expands from its internal energy alone as no heat is supplied. Under this case of expansion we have

$$C_v (T_2 - T_1) = \frac{R}{1-n}(T_2 - T_1)$$

4. When $n = \frac{1}{0}$ or in other words when n has an infinitely large value, we have

$$pv^n = K$$

$$p^{1/n} v = K^{1/n}$$

$$\text{Substituting } n = \frac{1}{0} \quad p^0 v = K^0 \quad \text{or} \quad v = 1$$

Hence in this case the volume remains equal to unity or no expansion takes place at all. In other words the external work is zero for

$$W = \frac{R}{1-n}(T_2 - T_1) = 0$$

and all the heat supplied goes toward raising the temperature of the gas and is equal to

$$Q = C_v (T_2 - T_1)$$

Such fundamental equations as are discussed in this lecture have most important applications. In nearly every computation involving gas or steam engine design some one of these equations must be taken into account. The student, then, should thoroughly familiarize himself with them and see if he can solve such problems as are contained in the following Thermotwisters.

Thermotwisters.

1. If 50 B.t.u. are added to 6 lb. of air having a pressure of 30 lb. per sq. in. and a volume of 35 cu. ft., what is the final v, p, t and the work done?

(a) When the heat is supplied and expansion takes place at constant pressure.

(b) When the heat is supplied and expansion takes place at constant temperature.

(c) When the heat is supplied and the volume remains constant.

(d) When the heat is supplied and the expansion follows the law $pv^{0.4} = K$.

2. The above air expands adiabatically until the final volume is 70 cu. ft., what is the final p, t and the work done?

SOLUTION OF THERMOTWISTERS, TENTH LECTURE.

1. Allowing for an efficiency of 75 per cent, what is the power required to drive a mechanical draft fan with a rounded-off conical mouthpiece 7 in. in diameter which delivers air at 2 oz. pressure with a velocity of 86 ft. per sec.?

On page 425, we find theoretic power in ft. lb. per sec.:

$$P = av \times \frac{v^2 d}{2g} \qquad \text{Also } p = \frac{v^2 d}{2g}$$

$$\therefore P = p\,av$$

where $p = 2/16$ lb., since coefficient of contraction $= 0.98$,

$$a = .98 \frac{d^2}{4} = .98 \times .7854 \left(\frac{7}{12}\right)^2, \quad v = 86$$

$\therefore$ Horsepower taking account of efficiency

$$= \frac{2}{16} \times .98 \times .7854 \times \frac{49}{144} \times \frac{86}{.75 \times 550} = .0034. \quad \text{Ans.}$$

2. If the diameter of the above fan is 27 in., what is the number of revs. per min. it undergoes?

In one rev., perimeter of wheel travels $\times d$ ft.

$$\therefore \text{No. of revs. per sec.} = \frac{86}{d} = \frac{86 \times 12}{3.1416 \times 7} = 4.7.$$

$\therefore$ revs. per min. $= 60 \times 4.7 = 282$. Ans.

3. Air is driven through a pipe 12 in. in diam. 2000 ft. long. The difference in pressure between the two ends is 4 oz. How many lb. of air are delivered per min. and what is the velocity of the air and the horsepower required?

To compute D, assume ordinary atmospheric conditions of pressure of 14.7 lb. per sq. in. and temperature of 65° F. Hence $p = 14.7 \times 144$, $R = 53.37$, $T = 459.4 + 65 = 524.4$.

$$pv = RT, \text{ but since } D = \frac{1}{v} \text{ we have}$$

$$\therefore D = \frac{p}{RT} = \frac{14.7 \times 144}{53.37 \times 524.4} = .0757$$

$$\therefore W = 64 \left(\frac{0.25 \times 0.0757}{4.6 \times 2000} \right)^{\frac{1}{2}} = .00919 \text{ lb. per min. Ans.}$$

SOLUTION OF THERMOTWISTERS, NINTH LECTURE.

3. The above power plant is located at an altitude of 5000 ft. above sea-level and crude petroleum is to be burned. What are the proper dimensions?

For crude petroleum a proper height is 100 ft. From Kent's tables I find on page 398 no data for 2000 horsepower at 100 ft. height. Hence I substitute in formula

$$\text{H. P.} = 3.33 \left(A - 0.6 \sqrt{A} \right) \sqrt{H}$$

$$2000 = 3.33 \left(A - 0.6 \sqrt{A} \right) 10$$

$$\text{or } A - 0.6 \sqrt{A}$$

I first try $A = 66$ and find this almost solves equation. I next substitute $A = 65$ and find equation roduces to zero. Since for crude petroleum, we require but ½ the area, our stack should have an area of 32.5 sq. in. or an inner diameter of 6.43 ft. or 77 inches.

Since, however, our plant is at an altitude of 5000 ft. above sea, I find that this corresponds to a barometric reading of 24.8 inches as compared with 30 inches at sea-level.

$$\text{Hence } r = \frac{30}{24.8}$$

$$H_1 = r\,H = \frac{30}{24.5} \times 100 = 122.5 \text{ ft. Ans.}$$

$$d_1 = r^{\frac{2}{5}}\, d = \left(\frac{30}{24.5}\right)^{\frac{2}{5}} \times 77 = 1.08 \times 77 = 83 \text{ ins. Ans.}$$

CLEVER ADVERTISING IN LOS ANGELES.

Below are some samples of the advertisements which the Southern California Edison Company flashed on the Auto-Racing Display device on South Broadway in Los Angeles.

They are designed to impress upon the public the advantages of electric signs over all other kinds of signs.

NIGHT SIGNS BRING DAY BUSINESS.
A PAINTED SIGN QUITS AT DUSK.
WRITE NIGHT LETTERS TO BUYERS.
CAN YOU SEE THE PAINTED SIGNS?
OUTLINE YOUR STORE WITH LIGHT.
SIGNS AT NIGHT BUYERS INVITE.

CENSUS STATISTICS ON GAS, ILLUMINATING AND HEATING.

The general summary shows increases in all the items at the census of 1909, as compared with that for 1904, except for miscellaneous expenses, which decreased 6 per cent.

The number of establishments increased 27 per cent; capital invested, 26 per cent; the gross value of products, 33 per cent; cost of materials, 41 per cent; value added by manufacture, 30 per cent; average number of wage earners employed during the year, 22 per cent; amount paid for wages, 23 per cent; number of salaried officials and clerks, 44 per cent; amount paid in salaries, 46 per cent; primary horsepower, 76 per cent.

There were 1296 manufacturing establishments in 1909 and 1,019 in 1904, an increase of 27 per cent.

The capital invested as reported in 1909 was $915,537,000, a gain of $190,502,000, or 26 per cent, over $725,035,000 in 1904. The average capital per establishment was approximately $706,000 in 1909 and $712,000 in 1904.

A general summary appears in the following tabulation:

GAS, ILLUMINATING AND HEATING—GENERAL SUMMARY: 1909 AND 1904.

	Census— 1909	Census— 1904	Per cent of increase, 1904–1909.
Number of establishments	1,296	1,019	27
Capital	$915,537,000	$725,035,000	26
Cost of materials used	$52,628,000	$37,180,000	41
Salaries and wages	$33,316,000	$25,522,000	31
Salaries	$12,385,000	$8,464,000	46
Wages	$20,931,000	$17,058,000	23
Miscellaneous expenses	$27,757,000	$29,557,000	[1] 6
Value of products	$105,814,000	$125,145,000	33
Value added by manufacture (products less cost of materials)	$114,186,000	$87,965,000	30
Employees:			
Number of salaried officials and clerks	13,515	9,406	44
Average number of wage earners employed during the year	37,215	30,566	22
Primary horsepower	128,350	73,101	76

[1] Decrease.

GAS, ILLUMINATING AND HEATING—PRODUCTS BY KIND AND QUANTITY: 1909 AND 1904.

		Census— 1909	Census— 1904	Per cent of increase, 1904–1909.
Gas, cubic feet	thousands	[1] 180,835,793	112,549,979	34
Straight coal		[1] 19,955,253	12,693,034	57
Straight water		1,726,082	715,500	141
Carbureted water		79,415,466	54,657,418	45
Mixed coal and water		46,775,285	40,980,414	[2] 1
Oil		8,686,800	3,441,352	152
Acetylene		[1] 25,186	7,881	220
All other		216,643	24,330	790
Coke	bushels	[1] 82,040,682	69,145,434	[2] 6
Tar	gallons	[1] 92,152,938	67,845,431	36

[1] In addition, in 1909, 27,588 thousand cubic feet of straight coal gas, 13,070 thousand cubic feet of acetylene gas, 44,347 bushels of coke, and 38,370 gallons of tar were produced by establishments engaged primarily in the manufacture of other products.
[2] Decrease.

The Auto-Racing Electric Display in Los Angeles.

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POWER AND GAS

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ROBERT SIBLEY, Treasurer and Editor in Chief
C. L. CORY, Secretary and Special Contributor
A. M. HUNT, Director and Special Contributor

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FOUNDED 1887 AS THE
PACIFIC LUMBERMAN, CONTRACTOR AND ELECTRICIAN

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Irrigation Ventures

Undoubtedly the irrigation project, founded on sound engineering principles, constitutes one of the safest investments open to capital. By means of it, worthless land is transferred into a living tangible asset. No more weird spectacle can be imagined than the bleak howling wilderness of sagebrush and desolation that constitute the arid lands of the West and yet how beautiful, how heavenly transformed become these identical lands under scientific irrigation and cultivation. The clear, wholesome morning air re-echoes in the sound of children's voices the blessings of health and happiness such projects repay to the nation.

During recent years the money markets have been stirred through and through in the financing of western irrigation projects. The earlier undertakings were successful from the start because the idea was new, the projects few, and the proposed irrigation scheme of simple operation. In recent years, however, projects involving acreages by millions have had a tendency to glut the market, not so much by the overdoing of the irrigation side as the non-education of prospective settlers.

The irrigation promoter of today must be alive to the fact that to make a project successful, the settler must be successful. The settler must be educated properly to handle his apple orchard with the same thrift and industry he sold magazines in his little stationery store in the heart of Chicago. This idea of coming out West to fish and hunt, while the apples mysteriously roll into the boxes, cart themselves to an eastern market, bringing six dollars a box is a forceful illustration of "Danny's" dream. The fundamental reasoning is sound and sane, however, as is testified to by thousands of happy settlers in the West.

Education and hard systematic study of conditions is the only ultimate solution. Our western water powers stand ready to pump water for millions of acres of arid lands not now available. Let us beware and see to it that the settler remains happy and contented for a happy contented settler is the biggest blessing possible to a successful enterprise and to the State.

A Clearing House For Trouble

It was a beautiful myth enjoyed by the ancient Greeks that no trouble was known to the world until Pandora was given the now famous mysteriously sealed box and womanlike, possessed of an uncontrollable curiosity to view its inner contents, she one day opened the lid only to find that she had liberated countless spirits of trouble to ever after plague mankind. Whether or not she realized the bickerings, the jealousies, the untold sufferings she was thus bringing to human beings is of little concern. The fact remains that ever since she thus pried the lid off, trouble has been among us.

In the every day run of human business affairs numberless misunderstandings arise. It makes little difference whether or not we as a matter of fact actually wronged a man, if he thinks we have wronged him the harm is done just the same.

And so it is in affairs electrical. In the busy run

of life the central station man ever planning and working to broaden and deepen his field of activity at times seemingly treads upon territory rightfully owned by the jobber or the contractor. The contractor in his feverish endeavors to increase his own influence drives contracts and purchases his supplies in ways which bring forth criticism from the jobber or the retailer and even the one who finally saddles the whole cost of electrical power and supplies, the consumer, has at times, it must be admitted by all, a rightful demand to call for at least the respect and consideration due a member of the vertebrate family of organisms.

Every living thing travels. Many smaller animals in their wanderings encircle the globe. Rats do. Troubles, like living organisms, seemingly are in a perpetual state of agitation. They spread as rapidly as a school-girl's secret.

Some weeks ago the Journal, with the assistance of others direct from the firing line, invited a few of the jobbers, the central station men, the contractors, the manufacturers, the retailers, and engineers, to a get-together-luncheon at the Palace Hotel in San Francisco to meet Philip S. Dodd, secretary of the National Electric Light Association, and incidentally talk over the betterment of the mutual relations of all concerned. The project has met with unanimous support from all quarters. A strong realization is felt that after all a mutual interchange of ideas and friendly criticisms in a clearing-house for trouble, such as proposed by the men present would result in the unquestioned betterment of all concerned.

It is surprising what a straightforward man-to-man talk can do on such occasions as this. A perfect team work among confiicting interests is secured and such harmony generally brings from the ever-watching public an increased patronage.

A meeting is called for the 28th of November in San Francisco at which time ideas will be presented involving a permanent organization with monthly meetings for all those in any way interested in electrical affairs. The committee has in view the annihilation of the social side as far as possible, although the monthly meetings will be held around the festive board of some of the city restaurants. The whole idea pervading those interested in the movement is to forward the electrical interests on the Coast by open, clear, frank expressions as to how mutual cooperation of all concerned can be best obtained.

The idea suggests at once similar gatherings in the other electrical centers on the Coast. Spokane, Seattle, Portland, Los Angeles and the other distinct distributing groups on the Coast would do well to promulgate similar meetings of cooperation, within their fields of activity. Undoubtedly the idea is not entirely new, for in the past the jobber, the central station man, the retailer, the manufacturer, and the engineer have all had their separate organizations, but never has there been this proposed dovetailing of divergent interests for the common good. More earnest endeavors, candid and friendly criticisms, and talks of the kind that touch the heart-strings of men, will do worlds of good in furthering electrical development on the Coast.

And Why Not?

Each year the civilized world is startled and yet fascinated by reading the pranks and fantasies of the famous gridiron club at Washington in annual banquet assembled. Many of the most potent electrical men of the Coast are about to form, as stated above, an organization in San Francisco to promote the welfare of all those interested in matters electrical within the sphere of their influence. It is proposed that the meetings be serious and earnest, avoiding as far as possible the social side of gatherings of this nature. The idea is excellent and much good cannot help but follow. The particular group in question, illustrative of the spirit of good fellowship known only to those engaged in electrical matters, must have some means, however, of opening up a circuit breaker at the proper intervals when running under such heavy loads as will be occasioned from time to time in the serious discussions anticipated.

Since the days when early Spanish settlers named the great golden gate city after their religious patron, Saint Francis, the very name itself has so entered the hearts of the thousands throughout the world who have at one time or another been guests of this western metropolis but one and only one solution can be offered as a condenser to absorb the enormous charging current created by these serious gatherings—and that is, once a year, to hold at San Francisco an electrical high jinks in the way of a unique electrical dinner.

San Francisco is unique among cities in her method of handling her dignified banquets at the Palace or St. Francis, her spicy evening dinners at the Techau, the Poodle-dog or Taits, and even her love feasts at breezy Sanguinetti's on a Saturday night. In this new venture, however, something entirely different is suggested. It is suggested to make it a gathering to which electrical men of the Coast be invited, and that the features of the evening be as novel and unique as the advance of the electrical profession will allow. In a word that such toasts which the committee in charge think best to be given during the evening be interspersed with electrical surprises, novelties and stunts, so that Bill Jones will go home ready to take a new lease on life for the serious duties of the next year, and also so that he will go home with a more wholesome reality of the true worth and genuine friendship of his fellows engaged in the upbuilding of a great Western electrical empire.

But three such annual occurrences can possibly take place before the arrival of the year of years when the proposed international electrical congress will be held at San Francisco during the Panama-Pacific International Exposition. It is an old saying that there is luck in odd numbers, if so, let us all improve these three preliminary "try-outs" to the very best possible advantage and in the fourth let us have an electrical high jinks and banquet that will demonstrate to the entire electrical world the sterling composition of the men who in the West in affairs electrical, stand for all that is true, all that is earnest and all that is progressive.

So here's for the electrical banquet: Please pass the electric currents!!

PERSONALS.

J. W. White of the sales department of the Fort Wayne Electric Works, is at Los Angeles on business.

F. W. Loomis, illuminating engineer with the Holophane Company, spent the past week at Los Angeles.

A. K. Detweiler, of Detroit, who is interested in the Home Telephone Company, is at San Francisco.

W. W. Briggs, assistant sales manager of the Westinghouse Electric & Mfg. Co. has returned to San Francisco from the East

George Cross, western manager for the Humphrey Water Heater Company, of Kalamazoo, Michigan, is at Los Angeles.

H. E. Sanderson, manager of the Bryant Electric Company's Pacific Coast branch, has returned to San Francisco from Monterey.

E. V. D. Johnson, general manager of the Northern California Power Company, with headquarters at Redding, is at San Francisco.

H. M. Cooper, who is connected with the Pacific Gas & Electric Company, headquarters at Auburn, is a recent arrival at San Francisco.

H. E. Eisenmenger is making a trip throughout the Pacific Coast in the interests of the National Electric Lamp Association of Cleveland.

George W. Bacon, president of the Sierra & San Francisco Power Company, is at San Francisco, conferring with President Calhoun and others.

W. R. Alberger, vice-president of the United Properties Company, returned to Oakland during the past week, after spending a number of weeks in the East.

J. F. Poindexter, a district manager of the Pacific Gas & Electric Company, with headquarters at Marysville, has been spending a few days at San Francisco.

R. D. Holabird, president of the Holabird-Reynolds Electric Company, returned to San Francisco, during the past week, after an extensive eastern tour, and left later for Los Angeles.

George Scaife, of the Pacific Gas & Electric Company, is said to have been a forceful speaker at the second annual dinner of the Grass Valley (Cal.) Chamber of Commerce during October.

P. H. Ridgeway, formerly with the Electric Engineering Company of Seattle, has opened offices at 709 Central Building, Seattle, and will continue to undertake consulting and construction engineering.

H. L. Dougherty, of J. G. White & Co.'s engineering staff, who was superintending the construction of the San Joaquin Light & Power Corporation's hyroelectric plant in Crane Valley, has just gone East on a short vacation trip.

E. G. Williams, general manager of construction for J. G. White & Co., of New York, is making an inspection tour of the California plants installed under the firm's supervision, in company with H. A. Lardner, the Pacific Coast manager.

Frank C. Bates, senior member of Bates & Clark, hydraulic engineers and contractors of Seattle, returned recently from a two months' visit to his old home in Wisconsin. Mr. Bates has an attractive mountain orchard home in the Bitter Root Valley, Montana.

A. G. Jones, superintendent of the General Electric Company's motor sales department at San Francisco, who recently returned to San Francisco from the East, was operated upon for appendicitis last Wednesday at the Lane Hospital and is making a rapid recovery.

Theodore N. Vail, who is at the head of the American Bell Telephone Company and president of the Western Union Telegraph Company, is at Los Angeles, where his presence has given rise to rumors that additional independent telephone companies are likely to be absorbed.

E. W. Rollins, head of E. H. Rollins & Sons, is expected to arrive at San Francisco this week with Richard B. Young, who is vice-president of the above firm and a director in the Great Western Power Company.

J. B. Potter, general superintendent of the Oakland Railways, has returned to Oakland after spending a number of weeks in the East inspecting the principal electric railway lines, power plants and factories. His observations will be utilized in the improvement of the Key Route and Oakland traction systems.

H. P. Wilson of New York, who is prominent in the financial councils of the Great Western Power Company, is at San Francisco after inspecting the company's hydroelectric plant at Las Plumas and the site of the new dam at Big Meadows. He was accompanied by Richard Young and Anson W Burchard, both Great Western directors.

Mason B. Starring, the new president of the United Railways Investment Company, is at San Francisco looking over the United Railroads system, with James H. Reed and Patrick Calhoun. Starring has expressed himself as very favorably impressed with both the street car system and the rebuilt city. He is well known in connection with electric railways in Chicago.

Philip Aaron, manager of the Western Electric Company's Seattle branch; C. R. Dedrick, head of the Dedrick Electric Supply Company, of Portland, and E. J. Dwyer, manager of the Holabird Electric Company, of Seattle, composed a group of electrical men who stopped over a few days at San Francisco, after attending the jobbers meeting at Del Monte, and then proceeded north during the past week.

Glenn C. Webster, manager of the engineering department of the National Electric Lamp Association, Cleveland, started Friday, November 17th, on an extended western trip. On Friday afternoon he gave an address on the "Value of Co-operation in Modern Business Enterprises" at the banquet of the National Cloak and Skirt Manufacturers' Association, at Toledo. He is now on his way to Los Angeles, where he will have general oversight of the National Electric Lamp Association's exhibit at the Electrical Exposition. Mr. Webster expects to make a study of industrial conditions in San Francisco and other Coast cities, returning to Cleveland late in December.

EXHIBIT OF THE NATIONAL ELECTRIC LAMP ASSOCIATION AT LOS ANGELES ELECTRICAL EXPOSITION, NOVEMBER 25TH TO DECEMBER 9TH.

The National Electric Lamp Association's exhibit is located near the center of the building in booths 75 and 76.

Most prominent among the various pieces showing incandescent lamps is the "Holophane tree." This is a large tree shaped fixture finished in statuary bronze on which are shown Mazda-Holophane units of six different sizes, the whole being surmounted by a 500-watt lamp. The circuits are controlled by a flasher which lights the different tiers of lamps successively.

A great variety of miniature and low-voltage lamps with drawn wire filaments are shown in a glass case, while lamps designed for automobile use are displayed in modern headlights, side lights, etc. A full line of multiple lamps is on exhibition in a case lighted with Mazda 5-watt sign lamps. The floral decorations of the booth are supplemented by decorative lamps in the shapes of flowers, fruits, animals, etc., especially suited for Christmas tree lighting.

The exhibit is in charge of Mr. F. J. Blaschke. Mr. G. C. Webster, manager of the engineering department, is also in attendance at the booth.

ELECTRICAL CONTRACTORS' NOTES.

George Duffield, special representative of the National Electrical Contractors' Association, is making an extensive trip throughout the Pacific Coast. Mr. Duffield has been successful in getting members of the national association and is well pleased with results, having obtained about seventy-five members, which will entitle California to three delegates in the national convention, which takes place in Denver, July 17.

Q. R. Boynton, manager of Central Electric Plumbing and Heating Company, made a business trip to Stockton and Sacramento during early part of week.

W. S. Hanbridge has been in San Jose during the past week on electrical contractor's business.

JOBBERS PLAY GOLF.

While co-operation was the purpose of the gathering of a number of electrical men at Del Monte, California, last week, competition in the regular golf match proved to be the most interesting feature of the meeting. The jobbers vied for two cups, the Patton trophy and the Ever Read cup, E. J. Dwyer of Seattle proving the victor in the first match and A. H. Elliott winning the second. The manufacturers' representatives competed for a cup presented by the jobbers' association, Gregory carrying off the honors. The results of the play follow:

	Patton Cup.			Ever Ready Cup.		
Player.	**Score.**	**Hdc.**	**Net.**	**Score.**	**Hdc.**	**Net.**
Hillis	97	8	97	97	5	92
Berry	87	+12	99	87	..	87
Dwyer	**109**	**27**	**82**	109	15	94
Carter	103	2	101	103	7	96
Gleason	99	+6	105	99	10	89
Hall	108	5	103	108	15	93
Elliott	106	18	88	**106**	**20**	**86**
Reynolds	105	..	105	105	5	100
Dederick	113	27	86	113	24	89
Goodwin	100	+13	113	100	+1	101
Berger	127	27	100	127	24	103

Manufacturers'-Jobbers' Cup.			
	Score.	**Hdc.**	**Net.**
Sanderson	85	+8	93
Bibbins	97	10	87
Gregory	**96**	**18**	**78**
Young	129	24	105
Squires	139	20	119
Lauritzen	88	5	83
Herr	149	24	125
Poss	109	10	99
Oakes	118	20	98
Steel	110	24	86
Russell	160	24	134

LOS ANGELES NEWS LETTER.

The city of Los Angeles Aqueduct Department have received bids for the transformers and generators for power plant No. 1 in the San Francisquito Canyon and will receive bids for the wheels on November 24th.

The Pacific Electric Railway Company have authorized the issuance of $100,000,000 in bonds for extensions, betterments and improvements. One thousand miles of extensions are contemplated, reaching from Santa Barbara to San Diego. Grading is rapidly nearing completion on the Colton branch and surveying parties are now working in San Bernardino, Orange and Ventura counties. Right of way men are now working in the San Fernando Valley, with the intention of extending the lines from Burbank on to Santa Barbara.

The Economic Gas Company have filed suit in the Superior Court restraining the City Council from enforcing the 80 cent rate. Consumers connected to this company are now receiving gas as low as 73¾ cents per 1000 feet, under the discount system.

Fire Chief Ely, of Los Angeles, has made his report to the Board of Fire Commissioners on the fire alarm situation. The report of Chief Ely was the result of an extended trip throughout the East, gathering data on different systems. While the report does not recommend the adoption of the Cregiar apparatus, it endorses that system of construction as being superior to the series system. The board have the matter under consideration and are expected to make a report to the special committee appointed by the council, recommending the installation of a complete system covering the entire city, 60 per cent of the installation to be underground. The improvement is estimated at $500,000.00, which includes a new central station building.

C. H. Grist has submitted a proposition to the City Trustees, Beaumont, California, for an electric lighting plant, to be established in that city. If the City Trustees will guarantee fifty 80 c.p. street lights at a cost of $2 50 per month, he will establish the plant at once.

SPECIAL CORRESPONDENCE FROM THE PACIFIC NORTHWEST.

Floods in Western Washington, due to heavy rains and rapid melting of snow, washed out a bridge carrying Seattle's municipal water and power pipe lines, and also damaged the power dam above Moncton. As a consequence, the city streets were unlighted for several nights and a water famine was averted only by the most careful use of the reserve water supply in the service reservoirs. Repairs have been started on the pipe lines and it is believed that no further trouble will be experienced.

The delivery of sixteen more prepayment cars to the Portland Railway, Light and Power Company will complete the company's order of 100 cars for 1911 and will give a total of 601 cars in operation in Portland. The capacity of the barns has been increased to care for this rolling stock, which gives Portland move operating cars than any city of equal population in the country. This company has almost completed its second reinforced concrete substation at the terminus of the 28-mile steel-tower transmission line from the new power plant on the Clackamas River, near Estacada. This line has 228 double towers, temporarily equipped with a single three-phase line.

The executive committee of the Pacific Coast Claim Agents Association met at Portland during the past week to arrange for the annual convention at Los Angeles next May. The principal address was by B. S. Josselyn, president of the Portland Railway, Light and Power Company, who stated that it was his theory "that personal damage claims against the railways can only be handled by an absolute regard for the responsibilities involved. If you settle every case on the theory of the golden rule, 'to do to others as you would have them do to you,' you will create in the public mind an impression of fairness and justice; you will procure a settlement more often and less lawsuits. If a transportation company is responsible for the injury, then, I say, a full and complete settlement should be made." Those in attendance at the meeting were: T. G. Newman, of the Whatcom County Railway & Light Company, Bellingham, Wash.; George Carson, of the Seattle Railway Company, Seattle, Wash.; G. N. Smith, of the O.-W. R. & N. Co., Portland; A. M. Lee, of the Northern Pacific Railway Company, Seattle; T. G. Aston, of the Washington Water Power Railway Company, Spokane; E. M. Grover, of the Northern Pacific Railway Company, Tacoma, Wash.; E. H. Odell of the Tacoma Railway & Power Company, Tacoma; H. K. Reif, of the Spokane, Portland & Seattle Railway, Portland, and B. F. Boynton, of the Portland Railway, Light & Power Company, Portland.

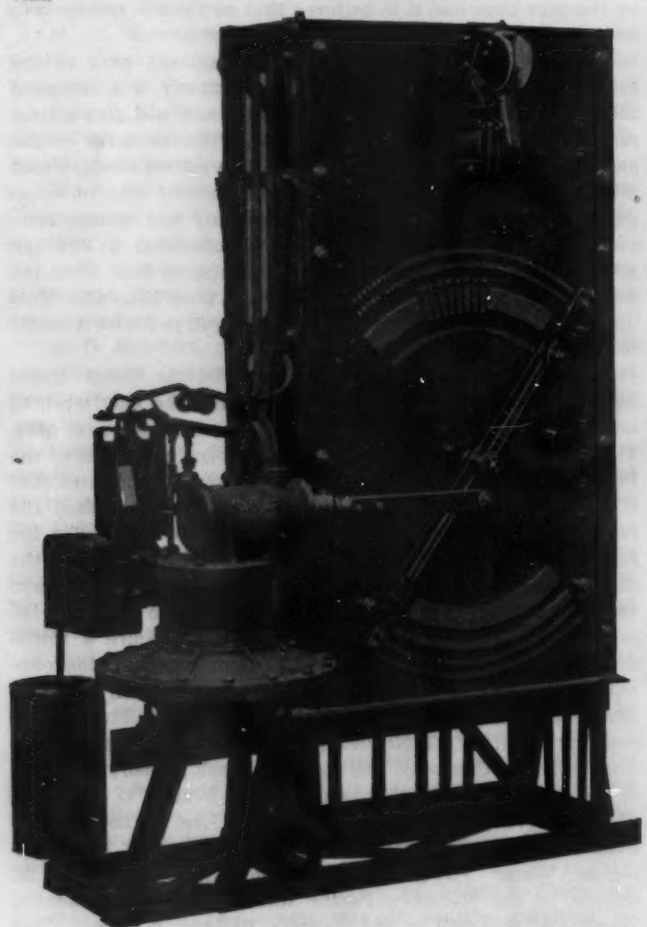
The United States Reclamation Service is investigating the feasibility of extending the Okanogan project in Washington by the addition of two units. Both will be irrigated by pumping. One unit includes 1100 acres in the present project limits, known as the Robinson flat, and requires a lift of 180 feet. The other will take in lands in the Colville Indian reservation. To perfect this it will be necessary to construct a power plant on Salmon River and transmit power to the various points from which water will be pumped into canals from the Okanogan River.

INDUSTRIAL

NEW REGULATOR FOR AUTOMATICALLY VARYING THE SPEED OF TWO MOTORS.

The Cutler-Hammer Manufacturing Company of Milwaukee has for some time built pressure controlled automatic speed regulators for varying the speed of single motors operating on mechanical boiler draft systems. The accompanying illustration shows a new type of controller which regulates two motors, stops or starts either or both of them and maintain the desired pressure in the boiler within certain fixed limits.

The panel illustrated was installed in connection with a 3½ h.p. motor and a 5 h.p. motor, each driving a triplex oil pump feeding oil-fired boilers. The oil is fed to the boilers under pressure of about 35 lbs. per square inch. The oil fed varies with the demands on the boilers. In this particular case the small pump takes care of ordinary operating conditions and both are used only when heavy load conditions prevail.



Cutler-Hammer Two-Motor Automatic Pressure Controlled Starter and Speed Regulator

The small motor is started automatically and accelerated to normal speed and above this if necessary. If this does not supply the oil needed the clapper switch, at the top, closes the circuit to the large motor and this is brought up to the speed required. When the demand on the boiler decreases so that the smaller motor can again do the work, the 5 h.p. motor is cut out of the circuit.

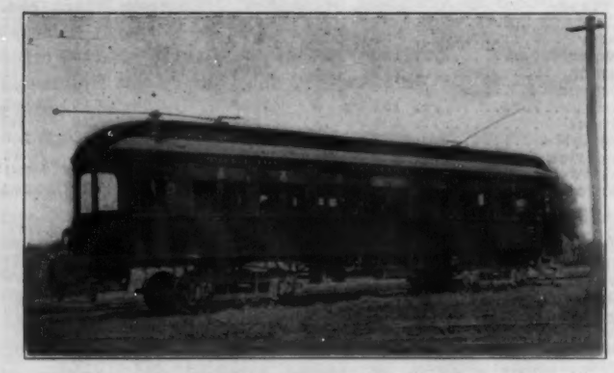
This controller, therefore, not only eliminates the need for an attendant and reduces power consumption to a minimum but it accomplishes the result precisely and infallibly; better than by manual operation.

NEW EQUIPMENTS OF TOLEDO, BOWLING GREEN & SOUTHERN TRACTION COMPANY.

The Toledo, Bowling Green & Southern Traction Company has purchased four quadruple equipments of Westinghouse No. 304 interpole railway motors and Westinghouse HL Control, arranged for operation from either end of the car. This company is replacing several old equipments with more modern apparatus designed to decrease maintenance costs and to give more efficient service.

While the change from the old to the new equipments is being made very gradually and only a few of the new ones, Fig. 1, are in operation, the performance of these indicates that with them maintenance costs will be considerably decreased.

The Westinghouse No. 304 motor, Fig. 2, is of the interpole type, with split frame and rated at 75 h.p., at 500 volts and 90 h.p., at 600 volts. By the use of interpole sparkless commutation is insured under all loads. This motor is lubricated with the oil and waste method with separate oil gauging reservoir. The oil is fed to the bearings by capillary attraction through a compartment filled with wool waste which effectively prevents any foreign matter from entering the



Car Equipped With New Type Motor Control.

bearings. The armature is of the Westinghouse spider construction and has a bolted commutator. The field coils are strap wound and spring packed which prevents chafing of the insulation due to vibration. This motor is peculiarly adapted for interurban or high speed service because of the relatively high armature speed.

The use of Westinghouse HL Control affords many advantages, chief of which are: a minimum of space is required by the master controller on the car platform; all heavy current carrying parts are located beneath the car, thereby reducing all possibility of injuries to passengers from controller "blowouts"; one or more cars can be operated in trains; the contacts are held together pneumatically, under heavy pressure, irrespective of line voltages.

Figs. 3 and 4 show open and closed views of the master controller used with HL control.

MOUND HOUSE PLASTER CO.

The Mound House Plaster Co., owning extensive deposits of gypsum and gypsite at Mound House, Nevada, has equipped a sixty ton mill for calcining the material before shipping to their Wall Board plant at Emeryville, Cal. The company has leased the property of the Realty Syndicate at Hollis street, Emeryville, together with the buildings. The machinery for the hydraulic press equipment has been ordered from the Plate Glass Co. of Pittsburg, Pa. Fairbanks, Morse & Co. have the contract for the complete electrical equipment, including the installation of the 275 horsepower motors.

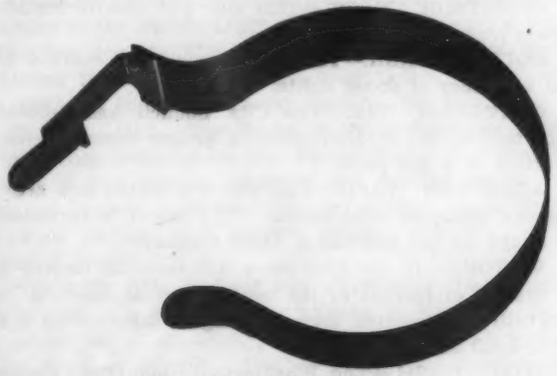
IMPROVED PLUG SWITCHES.

The Kellogg Switchboard & Supply Company have recently designed a new plug switch which differs very materially from the type previously used. When a plug is returned to its seat, it is necessary for the operator to force it in place in order to operate the plug switch springs. This method of operating makes it possible to use stiff springs, and hence, as platinum is used, the contact obtained is as reliable as that of a switchboard key.

Details of Improved Plug Switches.

This plug switch is mounted in a vertical position, thus making it practically impossible for dust to collect on the contacts. As it occupies a very little space, almost as many plug switches with associated plugs can be mounted upon a plug shelf as is possible when plugs with ordinary plug seats are used.

When a plug is forced into the plug switch, the sleeve of the plug makes contact with a metal roller, which in turn operates a small lever and closes or opens the plug switch contacts, depending upon the spring combination of the plug switch used.



New Enameled Head Gear.

The enameled head bands shown in the illustration are thoroughly insulated and are of light weight and inconspicuous when worn. They are proving especially serviceable in railway telephone dispatching work.

OCTOBER'S EARNINGS OFF 5 PER CENT FROM THE PRECEDING OCTOBER.

In sharp contrast with September, in which sales of the Western Electric Company showed an increase of 12 per cent over September, 1910, October shipments showed a decrease of 5 per cent compared with October a year ago. At the time, however, it was explained that the September gain came from orders booked earlier in the year, the company computing its business on the basis of shipments and not orders received, and that September's good showing did not mean an increase in orders received during that month.

But two more months of the companys year remain and it now seems fairly certain that the whole year's business will run very close to $66,000,000 which will make 1911 the second best year in the company's annals, being exceeded only by 1906, with sales of $69,000,000. An encouraging feature of the rapid strides the company made in the last three years is that the growth has been under normal conditions, and should, therefore, prove to be more or less permanent in character. The 1906 year was one of abnormal development in the telephone and allied industries, followed by a violent reaction.

Sales of the Western Electric Company for the ten months of the current year are about 3 per cent ahead of last year, the foreign branch of the company's interest showing up somewhat better than domestic business. In the United States during October all sections except the Pacific Coast district showed decreases. The East has been the section of the country to show the greatest falling behind.

TRADE NOTES.

S. O. Dolson, an electrical engineer for the Pelton Water Wheel Company, has gone to Butte County to install two Pelton water wheels of 800 h.p. each, at the Big Meadows damsite of the Great Western Power Company. These wheels will be direct connected to two General Electric generators and will be controlled by Pelton governors. The power generated will be used in connection with the big dam construction plant.

The Kellogg Switchboard & Supply Company has closed a contract with the Flathead Telephone & Telegraph Company for several exchanges in Montana that connect with the Lane Syndicate's lines, which are now operating through from Seattle to Butte. H. C. Goldrick, Pacific Coast manager for the Kellogg Switchboard & Supply Company of Chicago, reports that November, thus far, has been the best month of the year. Although there have been no very large orders there has been a good volume of small business.

Since the fire of 1906, Pierson, Roeding & Co., of San Francisco have been waiting for an opportunity to secure ground floor offices in a suitable location, and the completion of the Rialto Building has now made this possible. They have fitted up the southeast corner of the ground floor of the Rialto Building, and on December 2d, will remove from the Monadnock Building to their new location in the heart of the electrical jobbing district. A feature of the new arrangement will be a display room for exhibiting the firm's lines, including electric railway and transmission materials, storage batteries and high-tension oil switches. The new address will be No. 118 New Montgomery Street.

NOTICE OF MEETING.

An informal dinner meeting of the American Institute of Consulting Engineers will be held Friday, December 1st, at 7 p. m., at the Aldene Club, Fifth Avenue and 23d Street, New York City, for the purpose of welcoming the new members, and discussing matters of general interest to the Institute.

NEWS NOTES

FINANCIAL.

FALLS CITY, ORE.—The water bonds have been awarded to the Bank of Falls City. The bond issue is for $5000, running 20 years at 6 per cent. The purpose is for the extension of pipe lines of the city's water system.

SIERRA MADRE, CAL.—The $111,000 bond issue for the purchase of the plant of the Sierra Madre Company and for further development and extension of the system recently voted upon, has been passed by a large majority.

EUGENE, ORE.—Mayor Berger has signed and delivered $13,000 worth of the city's lighting bonds. Stephen Smeed, owner of the Hotel Smeed Building and of a fine farm near Walterville, has taken up the first $5000 of the bonds, and W. T. Campbell, city fire chief and capitalist, has taken $5000.

LOS ANGELES, CAL.—The Pacific Electric Company has filed with the county clerk a copy of papers authorizing a bond issue of $35,000,000. Of this amount $9,000,000 is set aside to guarantee the underlying bonds of the company, and the remainder will be used for betterments and in construction of the Big Creek power project in San Joaquin Valley. The Big Creek power development will be used in the operation of railroads and in the development of electric power pumping in Southern California.

SAN FRANCISCO, CAL.—Articles of incorporation have been filed by the San Francisco, Napa & Calistoga Railway, the capital stock of the corporation being $2,000,000. Prominent San Francisco and Oakland residents are among the incorporators: Alfred Sutro, T. V. Maxwell, Charles C. Sullivan, Guy C. Earl and W. H. Spaulding. The new railroad company will take over the holdings of the San Francisco, Vallejo & Napa Valley Railroad Company, which institution obtained its holdings from the Vallejo, Benicia & Napa Valley Railroad Company.

FAIRFIELD, CAL.—A deed of trust of the Sacramento & Woodland Railroad Company, a branch of the Vallejo & Northern, to the Mercantile Trust Company, of San Francisco has been filed with the county recorder. The deed is to secure bonds for $1,000,000 to be issued for the purpose of completing the road between Sacramento and Woodland. The mortgage covers the land included in the right of way, the machinery and shops, the electric power plants, the depots and sites, the ferry and other boats, the telegraph and telephone lines and all leases that the company possesses.

STOCKTON, CAL.—Papers permitting the Tidewater & Southern Railway Company to create a bonded indebtedness of $900,000 were filed in the office of the county clerk yesterday by Attorney A. L. Levinsky, who has, from the inception of the company, represented the officers in all matters. The bonds are to draw 5 per cent. The Union Trust Company of San Francisco will handle the bonds. The documents were signed by Karl C. Brueck, president: J. A. Cooley, Byron A. Bearce, J. L. Craig, George F. Schuler and T. J. Wisecarver, directors. Work is going forward on the new interurban road, which is being built between Stockton and Turlock through Modesto.

PALO ALTO, CAL.—Contending that the business men and property owners of Palo Alto should not encourage a rate cutting campaign intended to destroy the $200,000 investment of this city in its municipal power plant, the Board of Public Works has directed the attention of the local Chamber of Commerce to the large amount of patronage that is being given the United Gas & Electric Company. At a meeting held last week facts and figures were presented to the Chamber of Commerce showing the activity of the private corporation in the business district of the city. The names of those who have been using outside power and light were read at the meeting and an appeal will be made to the business men to support the municipal plant.

INCORPORATIONS.

LEWISTON, IDAHO.—In the County Auditor's office have been filed articles of incorporation for the Valley Development Company authorized to engage in water power and electrical development enterprises. The capital stock is $100,000, the shares being of the par value of $100 each. The incorporators are F. H. Nourse, E. Kilham and E. H. Booth, all of Lewiston.

RENO, NEV.—Articles of incorporation of the Nevada Valley Power Company have been filed in Reno and Carson. The company is incorporated for $2,500,000. A. D. Ayers, H. B. Danforth and A. A. Smith of Reno, and Milton S. Hamilton and F. J. Early of Oakland are the incorporators. They plan to build a plant on the Truckee River east of Reno, and to compete with the Hammon interests. The plant is to develop 4000 h.p.

TWIN FALLS, IDAHO.—Articles of incorporation have been filed with the county auditor by the Twin Falls, Artesian City and Oakley Interurban Railway Company. The capital is placed at $500,000 of which $180,000 is subscribed. Twin Falls is designated as the place of business. Harry T. West is president of the company. The purposes and powers are to construct, maintain and operate interurban railways in Twin Falls and adjacent counties; to construct and operate warehouses, flour mills, to locate and develop power rights, dam and reservoirs and canals for irrigation purposes, operate power houses, etc.

BAKERSFIELD, CAL.—Backed by capitalists of national prominence and having for its purpose the erection in Kern County of plants and lines for the supplying of light and power to towns, prospective railroads and mines, the Southern Sierra Power Company has given notice of its intention to invade the Southern San Joaquin Valley counties by filing articles of incorporation. The company is capitalized for $5,000,000, divided into 50,000 shares, and is at present operating in Colorado and Wyoming. Delos A. Chappell, Lawrence C. Phipps and C. F. Potter are the incorporators, and with T. S. Hayden and G. Wood compose the directorate. Lawrence Phipps Jr., the steel magnate of Pittsburg, will come to Kern County soon to look over the situation.

ILLUMINATION.

SUNNYSIDE, WASH.—This city will shortly install 7½ ampere magnetic lamps.

COLFAX, WASH.—The City Council has decided to install a number of street lights.

CORVALLIS, ORE.—The City Council has decided to grant to Col. W. H. McGoldrick a proper franchise for the operation of a gas plant.

ABERDEEN, WASH.—This city will install new arcs and tungsten lights on local streets. The power is furnished by the Grays Harbor Railway & Light Comany.

VICTORIA, B. C.—This place will consider cluster lighting system extensions at the next municipal meeting. Petitions will be presented urging the lights installed on a number of local streets.

TONO, WASH.—The Washington Union Coal Company, a subsidiary of the O.-W. R. & N. Co., has made an appropriation of $500,000 of which $250,000 will be expended for a light and power plant and 60 new houses in this city and vicinity. Other improvements will be made to mines and other property.

PASCO, WASH.—Evans, Dick & Co., were awarded the contract for furnishing and installation of 84 street light posts, with three cluster lights equipped for use. The firm's bid for the style of posts selected by the council was $5980.

MARTINEZ, CAL.—An application has been filed by Van F. Britton for a franchise for operating and maintaining gas mains and other pipes along the county roads, between the towns of Antioch and Pittsburg.

SANTA ROSA, CAL.—The bid of $200 made by the Pacific Gas & Electric Company, for permission to lay gas pipes and extend its mains along the Sebastopol and other roads, was accepted and the franchise granted.

ALBANY, ORE.—Col. W. H. McGoldrick, to whom the City Council recently granted a gas franchise in the city of Albany, has just been granted by the county a similar franchise which will be in conjunction with the city franchise.

CHICO, CAL.—A fifty year-franchise has been granted by the Board of Supervisors to the Pacific Gas & Electric Company to lay down and maintain gas pipes and mains for conducting gas to Chapmantown, Chapman's North Addition, Oakdale, Davis tract, etc.

LEWISTON, IDAHO.—Local Manager Henry M. Jones of the Pacific Power & Light Company, announced that plans are being completed for extending the gas mains to the University addition residence section, as far south as Sixteenth avenue. The improvements are to be completed not later than January 1st.

DUVAL, WASH.—Roy W. Comegys, of this city, who, with associates recently secured a franchise from King County for an electric light and water system franchise in this city and vicinity, will start work on the project at once. The franchise provides for the erection of pumping station, pipe lines, transmission lines, dam, etc., at a cost of between $200,000 and $300,000.

TRANSMISSION.

SAN JOSE, CAL.—The Supervisors have accepted the bid of the Great Western Power Company of $110 for the power pole line franchise that the corporation recently asked for and the franchise was awarded.

BUHL, IDAHO.—O. G. Gray has been here recently representing Salt Lake and Denver capitalists as a consulting engineer and has made investigations of the Thousand Springs power site. It is probable that work will be started shortly on the plant.

TUCSON, ARIZ.—The Great Western Power Company will commence active operations in construction of a $1,000,000 reservoir and power project in Sabino Canyon. This will irrigate 6000 acres. A road will be built to the canyon for transporting materials from Tucson.

VISALIA, CAL.—The Board of Supervisors has granted a franchise to the Pacific Light and Power Company, a branch of the San Joaquin Light and Power Company, of Fresno, to extend their poles and lines over Tulare County. The company paid into the treasury $100 for the franchise.

FRESNO, CAL.—The Board of Supervisors has adopted an ordinance granting to the Pacific Light & Power Corporation a franchise to construct and for the period of 30 years to operate and maintain an electric tower or pole and wire system upon certain public highways in the county of Fresno.

PORTOLA, CAL.—Work will at once be started on the construction of a dam on Grizzly Creek to furnish power for the generation of electricity, to be used in furnishing lights to the town of Portola. The Reno Mill and Lumber Company recently secured the water rights and franchises of the Portola Light & Power Company, and this work follows close on the outcome of that deal. Twenty men were taken to the site last week and the work will be pushed rapidly to completion. The estimated cost is $40,000.

PASCO, WASH.—Chief Engineer McGee of the Pacific Power & Light Company's engineering staff, made a preliminary survey of the site of the company's projected transmitting station. As soon as Mr. McGee can prepare profile maps, etc., contracts will be let for the project. The first building will be a distributing warehouse, 100x200 feet, with 60 feet walls. Other buildings will be established as soon as possible.

EUREKA, CAL.—As the result of negotiations which began several weeks ago, the Blue Lake lighting system, owned by the Minor Mill & Lumber Company, has been formally purchased and taken over by the Western States Gas & Electric Company. The generators which have thus far supplied Blue Lake with electrical energy were not bought by the Western States Company, only the distributing system being taken out. A crew of linemen will be put to work at once extending the transmission system of the Western States Company from Arcata to Blue Lake and within a few days the same current which is now lighting Eureka, Ferndale, Fortuna and Arcata will also be lighting Blue Lake as well as Glendale, a few miles north of Blue Lake. With the purchase of the Blue Lake system the Western States Gas & Electric Company now has control of the entire lighting and power situation in Humboldt County. It is stated that with the centralization of the former independent systems under one management a much more economical production of electrical energy will result with a consequent benefit to the consumer.

TRANSPORTATION.

WILLOWS, CAL.—President Donohue of the Sacramento Valley West Side Electric Railway, will make application to the County Supervisors for a franchise through Glenn County for the new electric road.

EDMONDS, WASH.—John Appleton and George Walsh of Seattle met with the local Chamber of Commerce to enter into negotiations for the construction of a street car line to connect this city with the interurban.

MEDFORD, ORE.—An interurban railroad connecting Medford, Ashland, Grants Pass and Jacksonville now seems to be a certainty, as the organizers have applied for a franchise, which will come before the next meeting of the City Council.

CALDWELL, IDAHO.—O. G. F. Markhus, manager of the Idaho-Oregon Power Company, met with the local municipal council November 6th and petitioned that body for an electric railroad franchise covering a number of local streets. No action on the matter has been taken.

BOISE, IDAHO.—A. B. Smith, representing unknown interests, asserts that his company will construct an electric railway line through South Boise to Nampa, and possibly connect the territory tributary. Another company is also petitioning the county for a franchise.

ALBANY, ORE.—According to reports, all obstables have been cleared for the construction of the Oregon Electric railway line between this city and the present terminus at Salem. Deals have been closed for several isolated strips of right-of-way. It is further said that regular trains will be in operation by January 1st, 1912. Practically 50 per cent of the grade has been completed and orders have been placed for steel and track laying facilities.

IRONDALE, WASH.—Reports from this place state that the sale of stock is progressing to such a degree as to warrant the immediate preliminary survey for right-of-way of the proposed interurban line for the Olympic Railway Company. Thomas Atwell, manager, stated that the project will probably be financed by Peabody, Houghteling & Co. Work will soon start on surveys and other preliminary work, with the intention of completing all preliminary work before February, 1912.

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